REMARKS

Claims 1-7 and 17-20 were examined. Claim 17 is amended. Claims 1-7 and 17-20 remain in the application.

The Patent Office rejects claims 1-4, 6-7 and 17-20 under 35 U.S.C. § 102(b). The Patent Office rejects claim 5 under 35 U.S.C. §103(a). Reconsideration of the rejected claims is respectfully requested in view of the above amendment and the following remarks.

A. After Final Amendment

Applicants amend claim 17. The amendment seeks to further distinguish claim 17 from the prior art and narrow the possible issues for appeal. Applicants respectfully request that the Patent Office enter the After Final Amendment as presented.

B. 35 U.S.C. §102(b): Rejection of Claims 1-4, 6 & 7

The Patent Office rejects claims 1-4, 6 and 7 under 35 U.S.C. §102(b) as anticipated by Matsuo. Matsuo describes the role of nitrogen (N_2) addition on CF_4/O_2 plasma chemical dry etching of polycrystalline silicon. Referring to Figure 10(d) and Section C.1 (pages 1804-05), there is described real-time ellipsometry for chemical dry etching processes. Specifically, a CF_4/O_2 plasma is supplemented with 20 sccm of N_2 and delivered to a chamber housing a polycrystalline substrate at time (c) (illustrated in Figure 10(d)). N_2 introduction apparently removes the surface roughness measurements seen with CF_4/O_2 discharge alone (at time (b)), indicating a formation of a reaction layer. It is the reaction layer that evidently reacts with the polycrystalline silicon. "At point (d), the microwave plasma is extinguished, but the sample remains exposed to the long lived species produced by the discharge. The formation of another layer takes place now. . . . This suggests that the postplasma effect is actually an increase in the reaction layer thickness. At time (e), the chamber is evacuated using the turbomolecular pump and the layer no longer changes in thickness." See page 1805, first column.

According to Applicants' understanding of Matsuo, CF_4/O_2 may be used to etch polycrystalline silicon with the product of polycrystalline silicon etching being SiF_4. See 1801, second column. Evidently, a reactive layer of SiO_xF_y is formed on the polycrystalline silicon to react with the silicon and produce SiF_4.

> A more highly fluorinated [SiF_xO_y reaction] layer would be both more responsive to each F atom arriving at the surface (i.e., a high probability that an impinging F atom could create volatile SiF_4), and subsequently more effective at removing Si atoms at the Si-reaction layer interface.

Page 1808, second column. An oxidized SiF_xO_y layer inhibits the reaction. Page 1801, second column.

Since Matsuo describes a chemical dry etching through the formation of a reaction layer, Applicants do not believe a fair reading of Matsuo includes film formation. In other words, a reaction layer is not a film and, presumably, is not retained after the etch process.

From the above quoted language, it is also clear that Matsuo describes the supplementation of a CF_4/O_2 plasma with nitrogen to evaluate the effects on the etch process on the reaction of fluorine with silicon to produce SiF_4. Matsuo does not describe nitrogen radicals that react with a substrate in a film conversion step.

Further, Matsuo, at Section III.A.2 (Etch Rates Versus Tube Length) teaches that, with the addition of nitrogen, etch rates drop with an increase in tube lengths. The best etch rate results involving CF_4/O_2 supplemented with N_2 are seen with "zero tube length." Thus, in connection with N_2 supplementation of an etch process of polycrystalline silicon, Matsuo teaches away from separating a plasma and an etch chamber.

Independent claim 1 is not anticipated by Matsuo, because Matsuo does not describe an apparatus including a second reaction chamber adapted to house a substrate for film formation processing, or coupling a first reaction chamber to a second reaction chamber with a substrate site separated by a distance equivalent to the lifetime of nitrogen plasma ions at a plasma generation rate, such that nitrogen radicals react with the substrate in a film conversion step.

Matsuo describes etching, not film formation. Matsuo describes fluorine reacting with silicon, not nitrogen reacting with the silicon. Matsuo teaches no separation is best between a plasma generator and an etch chamber when nitrogen supplementation is contemplated.

For the above-stated reasons, Applicants assert that independent claim 1 is not anticipated by Matsuo. Claims 2-4 depend from claim 1 and therefore contain all the limitations of that claim. For at least the reasons stated with respect to claim 1, claims 2-4 are not anticipated by Matsuo. Applicants respectfully request that the Patent Office withdraw the rejection to claims 1-4 under 35 U.S.C. §102(b).

Independent claim 6 is also not anticipated by Matsuo, because Matsuo does not describe an apparatus for film formation processing or means for providing a plasma from a nitrogen gas to the reaction chamber free of ions such that the radicals would react with a substrate in a film conversion step. As noted above with respect claim 1, Matsuo describes etching, not a film formation environment and does not describe nitrogen radicals reacting with a substrate in a film conversion step.

For the above stated reasons, independent claim 6 is not anticipated by Matsuo. Claim 7 depends from claim 6 and contains all the limitations of that claim. For at least the reasons stated with respect to claim 6, claim 7 is not anticipated by Matsuo.

Applicants respectfully request the Patent Office withdraw the rejection to claims 6-7 under 35 U.S.C. §102(b).

C. 35 U.S.C. §102(b): Rejection of Claims 17-20

The Patent Office rejects claims 17-20 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,082,517 issued to Moslehi (Moslehi). Moslehi describes a system for controlling a plasma density in a reaction chamber.

> "Consequently, there is a need for a device that adjustably controls the plasma-generating electromagnetic power that a fabrication process gas receives to produce a process plasma consisting of activated charged and neutral species."

Col. 2, lines 37-41 (emphasis added). Moslehi wants charged and neutral species.

Independent claim 17 is not anticipated by Moslehi, because Moslehi does not describe a system including a first reaction chamber and a second reaction chamber wherein the first reaction chamber is separated from the second reaction chamber by a distance suitable to deliver a plasma to the second reaction chamber substantially free of ions to react with a substrate in a film conversion step. Moslehi teaches delivering both charged and neutral species to a process chamber. Independent claim 17 is directed at minimizing "charged" species by the structural limitation of separating the plasma generation chamber ("first chamber") from a substrate site by a distance equivalent to the lifetime of ions.

For the above-stated reasons, claim 17 is not anticipated by Moslehi. Claims 18-20 depend from claim 17 and therefore contain all the limitations of that claim. For at least the reasons stated with respect to claim 17, claims 18-20 are not anticipated by Moslehi.

Applicants respectfully request the Patent Office withdraw the rejection to claims 17-20 under 35 U.S.C. §102(b).

D. 35 U.S.C. §103(a): Rejection of Claim 5

Claim 5 is rejected under 35 U.S.C. §103(a) as obvious over Matsuo in view of U.S. Patent No. 6,130,118 issued to Yamazaki et al. (Yamazaki). Yamazaki is cited for describing film deposition.

Claim 5 depends from claim 1 and therefore contains all the limitations of that claim. Accordingly, claim 5 is not obvious over the cited references because the references do not disclose or provide any motivation for an apparatus including a second reaction chamber adapted to house a substrate for film formation processing, or coupling a first reaction chamber to a second reaction chamber with a substrate site separated by a distance equivalent to the lifetime of nitrogen plasma ions at a plasma generation rate, such that nitrogen radicals react with the substrate in a film conversion step.

Applicants respectfully request that the Patent Office withdraw the rejection to claim 5 under 35 U.S.C. §103(a).

Attached hereto is a marked-up version of the changes made to claim 17 by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

Respectfully submitted,
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Dated: 9/24/01

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CERTIFICATE OF MAILING:
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231 on September 24, 2001.

Nedy Calderon 9/24/01
Nedy Calderon Date

ATTACHMENT: VERSION WITH MARKINGS TO SHOW CHANGES MADE

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Claim 17 has been amended as follows:

17. (Three Times Amended) A system for reacting a plasma with a substrate, comprising:

a first chamber;

a gas source coupled to the first chamber comprising constituents adapted to react with a substrate;

an energy source coupled to the first chamber;

a second chamber configured to house a substrate for film formation processing;

a system controller configured to control the introduction of a gas from the gas source into the first chamber and to control the introduction of an energy from the energy source; and

a memory coupled to the controller comprising a computer-readable medium having a computer-readable program embodied therein for directing operation of the system, the computer-readable program comprising:

instructions for controlling the gas source and the energy source to convert a portion of a gas supplied by the gas source into a plasma comprising plasma ions and radicals ~~and~~ ,

wherein the first reaction chamber is separated from the second reaction chamber by a distance suitable to deliver the plasma to the second chamber substantially free of ions to react with a substrate in the second chamber in a film conversion step.